DETAILED ACTION

Priority

1. Receipt is acknowledged of a certified copy of the provisional application 60/542,317 referred to in the oath or declaration or in an application data sheet. If this copy is being filed to obtain the benefits of the foreign filing date under 35 U.S.C. 119(a)-(d), applicant should also file a claim for such priority as required by 35 U.S.C. 119(b). If the application being examined is an original application filed under 35 U.S.C. 111(a) (other than a design application) on or after November 29, 2000, the claim for priority must be presented during the pendency of the application, and within the later of four months from the actual filing date of the application or sixteen months from the filing date of the prior foreign application. See 37 CFR 1.55(a)(1)(i). If the application being examined has entered the national stage from an international application filed on or after November 29, 2000, after compliance with 35 U.S.C. 371, the claim for priority must be made during the pendency of the application and within the time limit set forth in the PCT and Regulations of the PCT. See 37 CFR 1.55(a)(1)(ii). Any claim for priority under 35 U.S.C. 119(a)-(d) or (f) or 365(a) or (b) not presented within the time period set forth in 37 CFR 1.55(a)(1) is considered to have been waived. If a claim for foreign priority is presented after the time period set forth in 37 CFR 1.55(a)(1), the claim may be accepted if the claim properly identifies the prior foreign application and is accompanied by a grantable petition to accept an unintentionally delayed claim for priority. See 37 CFR 1.55(c).

2. Document filed as certified copy of foreign priority application is in fact a US provisional application, from which PCT/US2005/003889 claims priority of, and therefore does not meet the criteria of foreign priority.

Specification

1. The disclosure is objected to because of the following informalities: In the Cross-reference to related applications section of the specifications on paragraph 0001, the reference to the related PCT should recite the PCT application number.

2. The specification incorrectly claims benefit to provisional application 60/542,317 on paragraph 0001. PCT/US2005/003889 claims benefit to this provisional application and priority should be addressed accordingly. Refer MPEP 1828 [R-6].

Appropriate correction is required.

Information Disclosure Statement

3. The information disclosure statement (IDS) submitted on 10/16/2008 and 2/24/2010 is being considered by the examiner.

Claim Objections

1. Claim 1 is objected to because of the following informalities: the claim recites “the transmitters are capable of switching [hopping] to another subchannel and reconfiguring in any of or a combination of signal domains" which can be interpreted as an optional feature since the language does not positively tie the transmitters to actually

provide switching to another subchannel and reconfiguring, since they are merely capable of doing so. Furthermore, the "[hopping]" limitation should be removed or at least amended to recite "switching or hopping" since limitations in brackets can cause confusion to whether this limitation should be present in the claim. Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 13 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

6. Regarding claim 13, the limitation "at least one measure is taken to improve a channel condition of the at least one reserved subchannel" is indefinite because it is unclear to which subchannel is being referred to since there are more than one subchannel that can be used.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. **Claims 1,3-19 and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Khan et al. (US Pub 2001/0056560)(Khan hereafter) in view of Kim et al. (US Pub 2003/0095532)(Kim hereafter)**.

Regarding claim 1, Khan teaches a communication system [paragraph 0034][refer Fig. 3b], comprising: multiple transmitters (i.e. base transceiver stations (BTS))[refer Fig. 3b; 180][paragraph 0034] configured to transmit and retransmit data packets and associated control information [paragraph 0034], the transmitters use subchannels (i.e. RF channels) comprising groups of subcarriers (the transceivers transmit data bursts (i.e. subcarriers) over RF channels)[paragraph 0032];

the control information includes information concerning modulation schemes, coding rates, pilot patterns, training symbols, power levels, spatial processing schemes, modulation constellation arrangements, transmitter antenna techniques, subchannel

configurations in a multi-carrier system, or any combination thereof [paragraph 0032][refer paragraph 0009]; and

a hybrid ARQ (automatic repeat request) scheme is utilized for at least one of the subchannels [paragraph 0028][refer paragraph 0008]; and

multiple receivers configured to receive the data packets and the associated control information, wherein: the receivers are configured to feed back channel condition information (i.e. carrier-to-interference ratio (C/I) information is evaluated by the receiver to provide quality information used to determine redundancy to request)[paragraph 0037], comprising channel measurements along with an Acknowledgement/Negative-Acknowledgement (ACK/NACK) signal [paragraph 0038] to assist the transmitters to reconfigure a subchannel for retransmission of a failed packet or transmission of a next packet [paragraph 0036][paragraph 0040]; and

the channel measurements carries information about: received signal strength, average SINR (signal to interference plus noise ratio), variance in time, variance in frequency, variance in space, BER (bit error rate), FER (frame error rate), or MSE (mean square error), or any combination thereof, based on the received signals, the control information, or both (i.e. carrier-to-interference ratio (C/I) information is evaluated by the receiver to provide quality information used to determine redundancy to request)[paragraph 0037].

However Khan doesn't explicitly disclose that the transmitters are capable of switching [hopping] to another subchannel and reconfiguring in any of or a combination

of signal domains, for retransmission of a packet, based on received channel condition information and

the receivers are configured to feed back channel condition information, comprising channel measurements or channel quality indicator (CQI), along with an Acknowledgement/Negative-Acknowledgement (ACK/NACK) signal to assist the transmitters to select, reconfigure, or select and reconfigure a subchannel for retransmission of a failed packet or transmission of a next packet.

Kim discloses a system in which ACK/NACK messages sent over a CDMA or similar communication network comprises of a CQI (i.e. channel quality indicator) are in response to an n-channel transmission that was received over a particular channel, allowing a node to retransmit previously transmitted packet [paragraph 0047], Kim disclosing that in HARQ information indicating a channel number, packet number, and channel condition information allows the nodes to support cell selection that allows a node to correctly send information to an end device over a best cell through an appropriate channel[paragraph 0009].

It would have been obvious to one of ordinary skill in the art given the teachings of Khan for a hybrid ARQ system for error handling using ACK/NACK messages to incorporate the teachings of Kim for providing a CQI indicator with the ACK/NACK messages to notify a transmitter of channel quality so as to retransmit reliably. One would be motivated to do so to provide optimal performance through quality information of the channels [refer Kim; paragraph 0024][paragraph 0052].

Regarding claims 3 and 11, Khan doesn't explicitly disclose that at least one subchannel is reserved for retransmission of failed packets; at least one of the transmitters randomly selects one of the subchannels for retransmission; or

at least one of the transmitters, based on the channel condition information of all or some of the subchannels, selects a subchannel for retransmission to optimize system efficiency.

Kim discloses a system in which ACK/NACK messages sent over a CDMA or similar communication network comprises of a CQI (i.e. channel quality indicator) are in response to an n-channel transmission that was received over a particular channel, allowing a node to retransmit previously transmitted packet [paragraph 0047], Kim disclosing that in HARQ information indicating a channel number, packet number, and channel condition information allows the nodes to support cell selection that allows a node to correctly send information to an end device over a best cell through an appropriate channel[paragraph 0009].

It would have been obvious to one of ordinary skill in the art given the teachings of Khan for a hybrid ARQ system for error handling using ACK/NACK messages to incorporate the teachings of Kim for providing a CQI indicator with the ACK/NACK messages to notify a transmitter of channel quality so as to retransmit reliably. One would be motivated to do so to provide optimal performance through quality information of the channels [refer Kim; paragraph 0024][paragraph 0052].

Regarding claims 4 and 15, Khan teaches at least a first subchannel and a second subchannel are allocated for transmission.

However Khan doesn't explicitly disclose upon receiving a Negative Acknowledgement (NACK) signal indicating need for retransmission of a packet originally sent over the first subchannel, at least one of the transmitters swaps transmission of the first and the second subchannels and sends the packet to be retransmitted over the second subchannel.

Kim discloses a system in which ACK/NACK messages sent over a CDMA or similar communication network comprises of a CQI (i.e. channel quality indicator) are in response to an n-channel transmission that was received over a particular channel, allowing a node to retransmit previously transmitted packet [paragraph 0047], Kim disclosing that in HARQ information indicating a channel number, packet number, and channel condition information allows the nodes to support cell selection that allows a node to correctly send information to an end device over a best cell through an appropriate channel[paragraph 0009].

It would have been obvious to one of ordinary skill in the art given the teachings of Khan for a hybrid ARQ system for error handling using ACK/NACK messages to incorporate the teachings of Kim for providing a CQI indicator with the ACK/NACK messages to notify a transmitter of channel quality so as to retransmit reliably. One would be motivated to do so to provide optimal performance through quality information of the channels [refer Kim; paragraph 0024][paragraph 0052].

Regarding claims 5 and 18, Khan teaches multiple subscribers share one subchannel through time division multiplexing (i.e. Time Division Multiple Access (TDMA))[paragraph 0028][refer Fig. 7b]; and

multiple ARQ processes, each corresponding to a subscriber, are carried out in parallel [refer paragraph 0016][paragraph 0030].

Regarding claims 6 and 10, Khan teaches the transmitters and the receivers are at least part of base stations and mobile stations in the system [refer Fig. 3b][paragraph 0034], and the transmitters can change the subcarrier composition of a subchannel to contain a different ensemble of subcarriers and/or different training pilots [refer paragraphs 0002 and 0005][paragraph 0032].

Regarding claim 7, Khan teaches the receivers combine an originally transmitted signal and a retransmitted signal, which are transmitted over same or different subchannel, to detect data packets [refer paragraph 0009][paragraph 0038].

Regarding claims 8 and 24, Khan teaches a wireless multi-carrier packet communication apparatus [paragraph 0034][refer Fig. 3b], comprising: at least one transmitter (i.e. BTS)[refer Fig. 3b; 180] configured to transmit information packets [paragraph 0034], using subchannels (i.e. RF channels) comprising groups of

subcarriers (the transmitters transmit data bursts (i.e. subcarriers) over RF channels)[paragraph 0032];

at least one receiver (i.e. a remote unit)[refer Fig. 3b; 210] configured to receive the transmitted packets [paragraph 0034];

the at least one receiver is configured to send back channel condition information and an Acknowledgement/Negative-Acknowledgement (ACK/NACK) signal [paragraph 0036][paragraph 0040]; and

the at least one transmitter is further configured to employ a combination of FEC (forward error correction) and ARQ (automatic repeat request) schemes (i.e. hybrid ARQ)[paragraph 0028][refer paragraph 0008].

However Khan doesn't explicitly disclose that the at least one transmitter switches from a subchannel to another subchannel and reconfigures the other subchannel for retransmission of a packet signal in any of, or a combination of, variables by which the signal is defined,

and the at least one receiver is configured to send back channel condition information and an Acknowledgement/Negative-Acknowledgement (ACK/NACK) signal to assist the transmitters select and reconfigure one of the subchannels for retransmission of a failed packet or transmission of a next packet.

Kim discloses a system in which ACK/NACK messages sent over a CDMA or similar communication network comprises of a CQI (i.e. channel quality indicator) are in response to an n-channel transmission that was received over a particular channel, allowing a node to retransmit previously transmitted packet [paragraph 0047], Kim

disclosing that in HARQ information indicating a channel number, packet number, and channel condition information allows the nodes to support cell selection that allows a node to correctly send information to an end device over a best cell through an appropriate channel[paragraph 0009].

It would have been obvious to one of ordinary skill in the art given the teachings of Khan for a hybrid ARQ system for error handling using ACK/NACK messages to incorporate the teachings of Kim for providing a CQI indicator with the ACK/NACK messages to notify a transmitter of channel quality so as to retransmit reliably. One would be motivated to do so to provide optimal performance through quality information of the channels [refer Kim; paragraph 0024][paragraph 0052].

Regarding claim 9, Khan teaches the at least one transmitter and the at least one receiver are parts of base stations and mobile stations [refer Fig. 3b][paragraph 0034] and reconfiguring a subchannel for retransmission of a packet includes modulation schemes, Coding rates, pilot patterns, training symbols, power levels, spatial processing schemes, modulation constellation arrangements, transmitter antenna techniques, or a combination thereof [refer paragraphs 0002 and 0005][paragraph 0032].

Regarding claim 12, Khan doesn't explicitly disclose at least one subchannel is reserved for retransmission of failed packets.

Kim discloses a system in which ACK/NACK messages sent over a CDMA or similar communication network comprises of a CQI (i.e. channel quality indicator) are in

response to an n-channel transmission that was received over a particular channel, allowing a node to retransmit previously transmitted packet [paragraph 0047], Kim disclosing that in HARQ information indicating a channel number, packet number, and channel condition information allows the nodes to support cell selection that allows a node to correctly send information to an end device over a best cell through an appropriate channel[paragraph 0009].

It would have been obvious to one of ordinary skill in the art given the teachings of Khan for a hybrid ARQ system for error handling using ACK/NACK messages to incorporate the teachings of Kim for providing a CQI indicator with the ACK/NACK messages to notify a transmitter of channel quality so as to retransmit reliably. One would be motivated to do so to provide optimal performance through quality information of the channels [refer Kim; paragraph 0024][paragraph 0052].

Regarding claim 13, Khan teaches at least one measure is taken to improve a channel condition of the at least one reserved subchannel [paragraph 0032].

Regarding claim 14, Khan teaches the at least one transmitter uses modulation/coding/power schemes that matches channel qualities of corresponding subchannels [refer paragraph 0016], in which case retransmitted packets are fitted into subchannels by rate matching [paragraph 0038].

Regarding claim 16, Khan teaches retransmission over a subchannel uses same

settings as a previous transmission over that subchannel [paragraph 0016][paragraph 0038]; and

rate-matching is employed to fit current retransmitting packet onto same subchannel when current transmission packet size is different from previous transmission packet size on same subchannel (the redundant bits that are retransmitted may not be the same amount of information that was originally transmitted)[paragraph 0038].

Regarding claim 17, Khan doesn't explicitly disclose that the at least one transmitter stays on original subchannel for retransmission if:

there are no other subchannels available to the at least one transmitter at the time of retransmission;

the at least one transmitter has knowledge that a quality of original subchannel is better than or as good as the rest of available subchannels; or

the quality of original subchannel is sufficient to support a high modulation/coding index.

Kim discloses a system in which ACK/NACK messages sent over a CDMA or similar communication network comprises of a CQI (i.e. channel quality indicator) are in response to an n-channel transmission that was received over a particular channel, allowing a node to retransmit previously transmitted packet [paragraph 0047], Kim disclosing that in HARQ information indicating a channel number, packet number, and channel condition information allows the nodes to support cell selection that allows a

node to correctly send information to an end device over a best cell through an appropriate channel[paragraph 0009].

It would have been obvious to one of ordinary skill in the art given the teachings of Khan for a hybrid ARQ system for error handling using ACK/NACK messages to incorporate the teachings of Kim for providing a CQI indicator with the ACK/NACK messages to notify a transmitter of channel quality so as to retransmit reliably. One would be motivated to do so to provide optimal performance through quality information of the channels [refer Kim; paragraph 0024][paragraph 0052].

Regarding claim 19, Khan teaches some information about retransmission process is embedded in a header of each retransmitted packet [paragraph 0045].

Regarding claim 21, Khan teaches retransmission process continues until a packet is successfully received or a pre-specified number of retransmissions is reached [paragraph 0045].

Regarding claim 22, Khan teaches signal variables comprise time, frequency, space, signal power, modulation, or coding [refer paragraph 0003][paragraph 0028].

Regarding claim 23, Khan teaches a wireless packet communication method in a multi-user, multi-cell environment [paragraph 0034][refer Fig. 3b], comprising: transmitting a

signal indicating a need for retransmission of a failed packet (ACK/NACK messages are sent accordingly when a transmission was received poorly)[paragraphs 0036-0037];

receiving a retransmitted packet and associated control information signals [paragraphs 0037-0038];

measuring channel conditions based on received signals [paragraph 0037]; and

feeding back the channel condition measurements [paragraph 0040] for use in reformation processes, the reformation processes include at least one hybrid ARQ (automatic repeat request) scheme [refer paragraph 0010][paragraph 0028].

However Khan doesn't explicitly disclose that the retransmitted packet is received over a subchannel (i.e. RF channel) that differs from an original subchannel over which the failed packet was transmitted and the reformation processes include subchannel switching and at least one hybrid ARQ (automatic repeat request) scheme.

Kim discloses a system in which ACK/NACK messages sent over a CDMA or similar communication network comprises of a CQI (i.e. channel quality indicator) are in response to an n-channel transmission that was received over a particular channel, allowing a node to retransmit previously transmitted packet [paragraph 0047], Kim disclosing that in HARQ information indicating a channel number, packet number, and channel condition information allows the nodes to support cell selection that allows a node to correctly send information to an end device over a best cell through an appropriate channel[paragraph 0009].

It would have been obvious to one of ordinary skill in the art given the teachings of Khan for a hybrid ARQ system for error handling using ACK/NACK messages to

incorporate the teachings of Kim for providing a CQI indicator with the ACK/NACK messages to notify a transmitter of channel quality so as to retransmit reliably. One would be motivated to do so to provide optimal performance through quality information of the channels [refer Kim; paragraph 0024][paragraph 0052].

5. **Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Khan in view of Kim, as applied to claim 1, in further view of Ha et al. (US Pub 2003/0202500)(Ha hereafter)**.

Regarding claim 20, Khan provides support for measurement based hybrid ARQ that allows variance due to cases where redundancy transmitted depends on factors such as data delay requirements and scaling accordingly due to strict delay requirements [refer paragraph 0016], however Khan doesn't explicitly disclose that the apparatus implements a hierarchical Automatic Repeat Request (ARQ) process for a packet stream;

the ARQ process includes an outer loop and at least one inner loop; the outer loop operates at a higher layer with a traditional ARQ approach;

the at least one inner loop operates at a lower layer with one of the combination methods of FEC (forward error correction) and ARQ (automatic repeat request) (i.e. hybrid ARQ); and

parameters for both the outer and the inner loops can be changed depending on applications or unit processing capabilities.

Ha discloses the use of Hybrid ARQ or HARQ, in which the typical wireless communication system has an hierarchical structure, in which HARQ is achieved in the upper layer (i.e. outer loop) [paragraph 0054], the typical processing using an upper layer and a physical layer, the physical layer decoding a signal over a wireless channel (i.e. the output loop operating at a higher layer with a traditional ARQ approach)[paragraph 0055], the HARQ processing is achieved by the MAC layer (i.e. the lower layer or inner loop) [paragraph 0056].

It would have been obvious to one of ordinary skill in the art given the teachings of Khan for providing a HARQ communication system to incorporate the explicit use of upper and physical layers to provide the ARQ and HARQ operations within a wireless communication network as disclosed by Ha since one skilled in the art would see such incorporation as the typical application of a known means of using HARQ that provide predictable results.

6. **Claim 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Khan in view of Kim, as applied to claim 1, in further view of Ha in further view of Mantha et al. (US Pub 2006/0107192)(Mantha hereafter)**.

Regarding claim 2, Khan provides support for measurement based hybrid ARQ that allows variance due to cases where redundancy transmitted depends on factors such as data delay requirements and scaling accordingly due to strict delay requirements

[refer paragraph 0016], however Khan doesn't explicitly disclose that the transmitters implement a hierarchical ARQ process for a packet stream;

the ARQ process includes an outer loop and at least one inner loop; the outer loop operates at a higher layer with a traditional ARQ approach; the at least one inner loop operates at a lower layer with one of the hybrid ARQ method.

Ha discloses the use of Hybrid ARQ or HARQ, in which the typical wireless communication system has an hierarchical structure, in which HARQ is achieved in the upper layer (i.e. outer loop) [paragraph 0054], the typical processing using an upper layer and a physical layer, the physical layer decoding a signal over a wireless channel (i.e. the output loop operating at a higher layer with a traditional ARQ approach)[paragraph 0055], the HARQ processing is achieved by the MAC layer (i.e. the lower layer or inner loop) [paragraph 0056].

It would have been obvious to one of ordinary skill in the art given the teachings of Khan for providing a HARQ communication system to incorporate the explicit use of upper and physical layers to provide the ARQ and HARQ operations within a wireless communication network as disclosed by Ha since one skilled in the art would see such incorporation as the typical application of a known means of using HARQ that provide predictable results.

However, Khan in view of Ha fails to explicitly disclose that parameters for both the outer and the inner loops can be changed depending on applications or unit processing capabilities;

a number of retransmissions within the inner loops is set smaller for delay-sensitive applications than for delay-insensitive applications; and

the outer loop is removed for delay-sensitive applications.

Mantha discloses that in HARQ systems that have the ability to vary their throughput dynamically as channel conditions change, provides adaptability with fluctuating channel conditions by providing retransmissions to transmissions with a feedback where latency and delay is acceptable [refer paragraph 0013], however the HARQ protocol is used in delay-insensitive applications, and as such real-time web based applications, such as VOIP, are delay sensitive that require different type of ARQ protocol and different BERs and QoS [paragraph 0178], Mantha teaches the system accommodates a delay sensitive case by disabling retransmission requests based upon QoS information for the respective applications [paragraph 0180].

It would have been obvious to one of ordinary skill in the art given the teachings of Khan for providing a system providing a HARQ scheme to be modified to incorporate handling of delay-insensitive and delay-sensitive data flows accordingly based upon their requirements, as disclosed by Martha, when delay-sensitive flows require particular QoS, such as small delay, that HARQ may not be suitable for. One would be motivated to do so to provide accommodations to different communications that can populate a data communication system [refer Martha; paragraph 0180].

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ryan C. Kavleski whose telephone number is 571-270-3619 and fax number is 571-270-4619. The examiner can normally be reached on Mon-Fri 7:30am - 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dang T. Ton can be reached on 571-272-3171. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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